The Dynamic Effects of Stock Prices on Mutual Fund Flows and Volume in the Korean Stock Market

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Abstract

This paper examines the dynamic relationship among security returns, equity mutual fund flows, and trading volume using the monthly Korean stock market data. We employ various empirical methods including VAR analyses, Granger causality tests and a variation of the present value model. We find that Korean stock market returns Granger-cause equity mutual fund flows into the market, but not vice versa. We do not find evidence that the mutual fund flows directly affect stock market prices in the presence of fundamentals of firms. Instead, we find that fund flows seem to be influenced by the performance of the stock market and that investors try to forecast fundamentals of firms and change their demand for stocks accordingly.We find that the Korean stock market volume plays a significant role in predicting both returns and flows. This causal relationship is consistent with the sequential information arrival model (SEQ).

JEL classifications: G11; C22

***Keywords*:**Equity mutual fund flows; Causality; Unit root; Vector auto regression (VAR), Present value model

1.Introduction

Although there has been previous research into the empirical aspects of the stock price-flow relation, the preceding research has focused exclusively on well-developed financial markets, usually U.S. markets (see Warther, 1995; Remolona, Kleiman, and Gruenstein, 1997; Goetzmann and Massa, 2004; Edelen and Warner, 2001, Boyer and Zheng, 2004; Fortune, 1998; Potter and Schneeweis, 1998; Edwards and Zhang, 1998;Frazzini and Lamont, 2005). Given the divergent conclusions of earlier studies, further insights should be obtainable through an investigation of an alternative financial market, in particular, an emerging market: the Korean stock market. The advantages of employing an emerging market for such a study are several-fold. Because of its generally low correlation with more developed markets, the Korean market presents a separate data source. In addition, information flows in an emerging market are not equivalent to information flows in developed markets, and there are significant institutional differences across markets.

The Korean economy has witnessed unprecedented structural changes in the course of overcoming the financial crisis which hit it in December 1997. However, the economy began to regain its health and foster new areas of growth thanks to successful restructuring in both the corporate and the financial sectors in 1998. With industrial production up to pre-crisis levels, the Korean stock market has responded to such development by showing a drastic rise in stock prices since November of 1998. The Korea Composite Stock Price Index (KOSPI), the benchmark index of the Korean stock market, closed at 2,026.46 on December 30, 2016, up 436% from the closing index of 376.31 in 1997.

In the U.S., there is an intense debate over whether mutual fund flows have any relevance at all to the market's direction. Is the torrent of money pouring into mutual funds driving the market upward, or is the strong stock market driving investors to shovel millions of dollars into funds each month? And how much do mutual fund flows really matter to stock market movement in the first place? This debate is often reported in the financial press, as described recently in the*New York Times* and the *Wall Street Journal*.[1]

[1]E.g., the Wall Street Journal (WSJ) 4/10/98; WSJ 3/30/99; WSJ 4/5/99; New York Times 1/25/96; Busines Week 6/28/99.

Despite the considerable dispute, finance theory gives no clear answer to the question of whether changes in investment portfolio flows can cause changes in asset prices. Financial analysts and the popular press mainly attribute the run-up of stock prices to huge and incessant money flows into the stock market.

Their argument seems convincing: Equity mutual fund growth reveals a greater demand by individuals to hold stocks, and this price pressure must surely lead to higher stock prices as more investors chase a relatively fixed supply of corporate equity. On the other hand, a lower demand for equities by investors could result in widespread sales of stocks, sending stock prices plummeting.Under market efficiency, equity prices should be equal to the present value of expected future cash flows. Hence, equity prices should be affected only by fundamentals such as expected cash flows and discount rates (expected returns). As such, investment equity mutual fund flows should affect equity prices (and returns) only to the extent that they affect the fundamentals, which is through the information effect.[2] If equity mutual fund flows directly affect (or contain additional information that helps predict) stock returns in the presence of other fundamentals, it would be indicative of price pressure effect. This implication will be testedby a variation of the stock price valuation (present value relation) model that allows for both the information effect and the price-pressure effect.[3]

This paper aims to enhance the understanding of the dynamics in securities markets by analyzing the relationships among security returns, equity mutual fund flows, and trading volume in an emerging market: the Korean stock market from January 1, 1995, to December 30, 2016, using monthly data set of the Korean stock market. We employ various empirical methods: VAR (vector-auto regressions) analyses, Granger causality tests, a variation of the present value model,and the dynamic interactions between asset returns and equity mutual fund flows to examine the relationship. We also examine whether foreign investors actually influence the Korean stock market given the far-reaching perception that foreign investors are better informed and more sophisticated.

Using the monthly stock mutual fund flows, we find that Korean stock market returns are Granger-causally prior to stock mutual flows into the market, but not vice versa. We do not find evidence that the equity mutual fund flows directly affect stock market prices in the presence of fundamentals of firms. Instead, we find that equity mutual fund flows seem to be influenced by the performance of the stock market and that investors try to forecast fundamentals of firms and change their demand for stocks accordingly.We find that the Korean stock market volume plays a significant role in predicting both returns and flows. Information flow, however, conveyed by volume seems to disseminate slowly up to several months. This causal relationship is consistent with the sequential information arrival model (SEQ).

The paper is organized as follows. The next section describes the variables and the data. Sections 3 addresses methodologies and empirical results for the dynamic relationship among stock returns, equity mutual fund flows, and volume. Concluding remarks are offered in Section 4.

2. Data

The data on the Korean stock market are obtained from two sources: the Korea Exchange (KRX), which provides daily and monthly data on the Korea Composite Stock Price Index (KOSPI)-the benchmark index of the Korean stock market-, KOSPI dividend yields, and monthly trading volume. The dividend series is obtained from KOSPI dividend yields.[4]Monthly mutual fund flows into the stock market come from the Korea Financial Investment Association (KOFIA), the Korean version of the Financial Industry Regulatory Authority (FINRA). The sample period is from January 1, 1995, to December 30, 2016.

[2] It is debatable whether equity mutual fund flows are fundamentals or not [see, for example, Warther (1998)]. Our view is that if equity mutual fund flows directly affect stock market returns without affecting revisions in expectations of future cash flows and/or returns, they may be considered as fundamentals. Otherwise, they are not.

[3] It is interesting to note that Shiller, in his comment on Warther (1998), points out that "Granger or Sims causality tests might be employed to try to discover whether a causal relation exists from stock market returns to mutual fund flows."

[4]The t-ratios from predictive regressions of stock returns on the lagged values of financial fundamentals (e.g., dividend yields or price-earnings ratios) or macroeconomic indicators are subject to a small sample bias that may indicate that returns are more predictable than they in fact are. See Stambaugh (1986), Hodrick (1992), and Goetzmann and Jorion (1993). In particular, Goetzmann and Jorion (1993) point out that time-series studies of returns conditional upon any ratio involving price levels (e.g., dividend yields) are subject to a substantial bias. Several studies have explored the small sample problems of the VAR methods that include lagged endogenous variables (See Hodrick (1992) and Goetzmann and Jorion (1993)). Notice that we do not use dividend yields directly in the VAR model. Instead, we use returns, dividend growth, and equity mutual fund flow growth.

3.Empirical Framework andResults

3.1 Empirical framework for estimating the information effect and the price-pressure effect

This section provides an empirical model of measuring the informational price effect of possible information-bearing transactions [see Harris and Gurel (1986)]. We employ a variation of the present value model of equity valuation that allows for time-varying expected returns. Noting that, in an efficient market, only cash flows and/or changes in expected returns can affect stock prices (and returns), we test whether equity mutual fund flows directly affect stock prices (i.e., have price-pressure effects) in the presence of the present value of expected future cash flows and/or changes in expected returns. In doing so, we measure the extent of the equity mutual fund flow shock affecting stock market returns without being justified by its effect on subsequent cash flows and/or changes in expected returns. We begin with an equation in Campbell (1991), which is derived from the log-linear dividend-price ratio model of Campbell and Shiller (1989). It is obtained by taking a first-order Taylor approximation of the equation relating the log stock returns to log stock prices and dividends. The model allows both expected returns and expected future cash flows to affect stock prices. The equation states that the stock return in period t (h_t) is the sum of expected stock returns ($E_{t-1}(h_t)$) and unexpected stock returns. The unexpected stock returns include unexpected changes in rational expectations of current and future growth in cash flows and future stock returns:[5]

$$h_t = E_{t-1}\, h_t + (E_t - E_{t-1}) \sum_{j=0}^{\infty} \rho^j \Delta d_{t+j} - (E_t - E_{t-1}) \sum_{j=1}^{\infty} \rho^j\, h_{t+j}, \quad (1)$$

where h_t denotes the log real return on a stock held from the end of period $t-1$ to the end of period t (= log[(P_t + D_t)/P_{t-1}]), d_t denotes the log real cash flow paid during period t, E_t denotes an expectation formed at the end of period t, Δ denotes a difference operator (e.g., $\Delta d_t = d_t - d_{t-1}$), and ρ is a discount parameter a little smaller than one. The equation can be rewritten as

$$(E_t - E_{t-1}) \sum_{j=0}^{\infty} \rho^j\, h_{t+j} = (E_t - E_{t-1}) \sum_{j=0}^{\infty} \rho^j\, d_{t+j}. \quad (2)$$

The above equation equates unexpected changes in rational expectations of future real stock returns to the unexpected changes in rational expectations of changes in cash flows.

3.1.1 A measure of the price-pressure effect

One implication of the above model is that equity mutual fund flows should affect stock market returns to the extent that they affect current and future changes in real cash flows and/or changes in expected returns because $E_t(x) = E(x \mid \Omega_t)$, and the information set Ω_t includes changes in equity mutual fund flows ($\Delta flow_t$). I.e., $\Delta flow_t \in \Omega_t$. This equation motivates an alternative test of the informational price effect. Suppose that a shock to equity mutual fund flows may affect the stock market return directly without (or in addition to) affecting either current and future changes in real cash flows or changes in expected returns. We then may measure this effect by allowing another route to affect the stock market returns:

$$(E_t - E_{t-1}) \sum_{j=0}^{\infty} \rho^j h_{t+j}$$

$$= (E_t - E_{t-1}) \sum_{j=0}^{\infty} \rho^j\, [(1-\theta)\ \Delta d_{t+j} + \theta \Delta flow_{t+j}],$$

$$= (1-\theta)(E_t - E_{t-1}) \sum_{j=0}^{\infty} \rho^j\, \Delta d_{t+j} + \theta (E_t - E_{t-1}) \sum_{j=0}^{\infty} \rho^j\, \Delta flow_{t+j}, \quad (3)$$

where $flow_t$ denotes equity mutual fund flows. This equation shows that equity mutual fund flows affect stock returns, first, by way of current and future changes in real cash flows and/or changes in expected returns (called *the information effect*), and second, directly without affecting either current and future changes in real cash flows or changes in expected returns (called *the price-pressure effect*). The parameter θ provides a measure of the extent of the price-pressure effect independent (or in excess) of the information effect. To better understand the role of the parameter θ, we rewrite equation (3) as

[5]It should be noted that equation (1) allows for time-variation in expected returns instead of imposing a constant expected return. This is consistent with findings by, for example, Keim and Stambaugh (1986), Fama and French (1989), Fama (1990) and Schwert (1990).

$$h_t = E_{t-1}\, h_t - (E_t - E_{t-1}) \sum_{j=1}^{\infty} \rho^j\, h_{t+j} + (1-\theta)(E_t - E_{t-1}) \sum_{j=0}^{\infty} \rho^j\, d_{t+j}$$

$$+\theta(E_t - E_{t-1}) \sum_{j=0}^{\infty} \rho^j\, flow_{t+j}\,, \qquad (4)$$

which states that the stock return in period t (h_t) is the sum of expected stock returns ($E_{t-1}(h_t)$), unexpected changes in rational expectations of future stock returns with weight 1 (called *the expected return effect*), unexpected changes in rational expectations of current and future growth in cash flows with their weight (1-θ) (called *the cash-flow effect*), and unexpected changes in rational expectations of current and future equity mutual fund flows with their weight θ (called *the price-pressure effect*).

3.1.2An alternative measure of the price-pressure effect

By imposing the constraint that the cash-flow effect and the price-pressure effect sum to one, the approach in (3) (or (4)) enables us to identify and estimate the price-pressure effect by solving one equation in one unknown parameter θ. In addition, the estimate of the single parameter θ provides a measure of the relative size of the three effects--the expected return effect with its weight 1, the cash flow effect with its weight 1-θ, and the price-pressure effect with its weight θ-- and helps explain the relationship between stock returns and equity mutual fund flows.[6]The information that equity mutual fund flows may contain may be either about revisions in expected cash flows or about revisions in expected returns. Both these terms are fundamentals and may need to be treated symmetrically. Then we consider

$$(E_t - E_{t-1}) \sum_{j=0}^{\infty} \rho^j h_{t+j}$$

$$= (E_t - E_{t-1}) \sum_{j=0}^{\infty} \rho^j\, \Delta d_{t+j} + \gamma(E_t - E_{t-1}) \sum_{j=0}^{\infty} \rho^j\, \Delta flow_{t+j.} \qquad (5)$$

In this model, we do not restrict that the cash-flow effect and the price-pressure effect sum to one. Instead, we maintain the assumption that the expected return effect and the cash-flow effect are symmetric so that we do not allow for differential effects of equity mutual fund flows on revisions in expected cash flows and on revisions in expected returns. The price-pressure effect in this model is measured by the parameter γ.

3.2.Empirical results on the price-pressure effect

Table 1. Estimates of the Parameter of the Price-Pressure Effect θdue to Equity Mutual Fund Flows(Sample period:1/1/1995-12/30/2016)

Panel A.

$$(E_t - E_{t-1}) \sum_{j=0}^{\infty} \rho^j h_{t+j} = (1-\theta)(E_t - E_{t-1}) \sum_{j=0}^{\infty} \rho^j\, \Delta d_{t+j} + \theta(E_t - E_{t-1}) \sum_{j=0}^{\infty} \rho^j\, \Delta flow_{t+j}\,,$$

whereh_t,Δd_t,$\Delta flow_t$ denote stock market returns, dividend growth rate, and growth rate of equity mutual fund flows, respectively.

With 1 lag in a VAR:

ρ	θ	Standard Error	*t*-statistic	*p*-value
0.999	.0293	.0303	.9690	.3325
0.99	.0293	.0303	.9689	.3326
0.98	.0293	.0303	.9689	.3326
0.95	.0293	.0302	.9689	.3327

With 4 lags in a VAR:

ρ	θ	Standard Error	*t*-statistic	*p*-value
0.999	.0326	.0327	.9985	.3180
0.99	.0325	.0326	.9973	.3186
0.98	.0324	.0325	.9960	.3193
0.95	.0319	.0322	.9923	.3211

[6] An alternative, more general approach would be to allow for at least two parameters, one each for the information (cash flow) effect and the price-pressure effect. This approach, however, does not allow us to identify the two parameters. In addition, the interpretation of either the relative size of the three types of effects or the relationship between stock returns and equity mutual fund flows may not be very clear.

Panel B.

$$(E_t - E_{t-1}) \sum_{j=0}^{\infty} \rho^j h_{t+j} = (E_t - E_{t-1}) \sum_{j=0}^{\infty} \rho^j \Delta d_{t+j} + \gamma (E_t - E_{t-1}) \sum_{j=0}^{\infty} \rho^j \Delta flow_{t+j}$$

where $h_t, \Delta d_t, \Delta flow_t$ denote stock market returns, dividend growth rate, and growth rate of normalized equity mutual fund flows, respectively.

With 1 lag in a VAR:

ρ	γ	Standard Error	*t*-statistic	*p*-value
0.999	$.4073 \times 10^{-3}$	$.2399 \times 10^{-3}$	1.6978	.0896*
0.99	$.4042 \times 10^{-3}$	$.2373 \times 10^{-3}$	1.7035	.0885*
0.98	$.4007 \times 10^{-3}$	$.2340 \times 10^{-3}$	1.7099	.0873*
0.95	$.3903 \times 10^{-3}$	$.2257 \times 10^{-3}$	1.7294	.0837*

With 4 lags in a VAR:

ρ	γ	Standard Error	*t*-statistic	*p*-value
0.999	$.2813 \times 10^{-2}$	$.2040 \times 10^{-2}$	1.3786	.1680
0.99	$.2691 \times 10^{-2}$	$.1946 \times 10^{-2}$	1.3828	.1667
0.98	$.2560 \times 10^{-2}$	$.1845 \times 10^{-2}$	1.3875	.1653
0.95	$.2196 \times 10^{-2}$	$.1566 \times 10^{-2}$	1.4030	.1606

For the empirical estimation and test for the model in Section 3.1, we use the returns on the KOSPI Index. The empirical estimates of θ in equation (3) (or (4)) and γ in (5) are reported in Panels A and B of Table 1. For the estimation of θ, we need an estimate of the discount parameter ρ, which is obtained by the inverse of total returns [i.e., the inverse of (1 + sample mean of h_t)]. Using the sample average value of a monthly return of 0.026%, the average value of the discount parameter would be about 0.999. In addition, we also consider three other values of the discount parameter ρ 0.99, 0.98, and 0.95. For the estimation, we need to determine the lag length *m* in the VAR. Considering both Akaike (1974) and Schwarz (1978) information criteria, we include either one or four lags in the estimation. The estimates of θ and γ being a nonzero may indicate either that there exists a significant price-pressure effect or that the equity mutual fund flow shock impacts expected cash flows and/or stock returns in a way that is not captured by our proxy for expected cash flows and/or returns. The estimates of and γ being a zero implies, on the other hand, that the equity mutual fund flow shock is relevant to stock returns only to the extent that it affects current and future cash flows and/or expected returns.

Panel A of Table 1 shows that the estimates of the price-pressure parameter θ are positive but very small and statistically indifferent from zero. The estimates are around 0.0293 with one lag, and between 0.0319 and 0.0326 with four lags, respectively. Their significance levels are all above 0.31, which indicates that the null hypothesisθ = 0 (i.e., the absence of the price-pressure effect) is not rejected. This implies that equity mutual fund flow shocks affect the stock market through expected future cash flows and/or expected future returns. Estimates of θ are not very sensitive with respect to different values of the discount parameter ρ and different numbers of lags in the VAR estimation.Similar estimates are obtained for γ [Panel B]. The estimates are between 0.3903×10^{-3} and 0.4073×10^{-3} with one lag, and between 0.2196×10^{-2} and $0.2813 \times 10^{-2}$with four lags, respectively. The estimates with one lag are statistically different from 0 at the ten percent significance level, but they are economically insignificant at all. However, the estimates with four lags are statistically indifferent from 0 with their significance levels all above 0.16. This indicates that the finding of the insignificant price-pressure effect is not sensitive to different formulations of models and that the effect of equity mutual fund flows on stock returns are symmetric with respect to revisions in expected cash flows and revisions in expected returns.In sum, we may safely conclude that the price-pressure effect is very small and insignificant. Equity mutual fund flows seem to affect market returns through both revisions in expected future cash flows and revisions in expected future returns, and thus the stock market appears to respond in an indirect manner to equity mutual fund flow shocks. As such, these findings are consistent with the absence of a substantial price-pressure effect.

3.3. The contemporaneous relation among Korean stock market returns, equity mutual fundflows, and volume

First, we examine contemporaneous comovement of both the return-flow and return-volume relationships. To do so, we employ the two following regressions:

$Flow_t = \alpha + \beta Kospiret_t$ (6)

$Vol_t = \gamma + \eta Kospiret_t$(7)

WhereVol is the log difference of trading volume, Kospiret is the log difference of the KOSPI index (=log[$KOSPI_t/KOSPI_{t-1}$]), and Flow denotes the log difference of the mutual fund flows into the stock market. The results of these regressions are shown in Table 2 where Eq. (6) and Eq. (7) are displayed in Panel A and B, respectively. The result in Panel A indicates that the contemporaneous correlation between monthly returns and the fund flows is significantly positive for the Korean stock market. The result in Panel B shows that monthly returns and volume are also highly contemporaneously correlated. Panel C presents the correlation matrix among the three variables. The correlation coefficient between KOSPI returns and flow growth is reported in Panel C. The findings of significant contemporaneous correlation between them are consistent with those reported in the U.S. market (see Warther, 1995).

Table 2. Contemporaneous Relation of Korean Stock Market Returns, Equity Mutual Fund Flows, andVolume

This table provides the coefficient estimates from the regressions of fund flow (and volume) against price changes for the Korean stock market over the period January 1, 1995 through December 30, 2016. Vol is the log-differenced trading volume, Kospiret is the log difference of KOSPI index, and Flow denotes the log difference of the equity mutual fund flow into the stock market.

Panel A. Stock Return-Flow Relation

Regression results for $Flow_t = \alpha + \beta Kospiret_t$

Nobs	α	β	Adjusted R-squares
1556	0.0009 (1.45)	0.292* (9.03)	0.06

Panel B. Stock Return-Volume Relation

Regression results for $Vol_t = \gamma + \eta Kospiret_t$

Nobs	γ	η	Adjusted R-squares
1556	0.0012 (0.15)	2.09* (5.40)	0.02

- The numbers in parentheses are significance levels for the t-statistic.
- * Significant at the 1% level.

Panel C. Correlations

	Kospiret	Flow	Vol
Kospiret	1		
Flow	0.244	1	
Vol	0.148	0.182	1

Using a variation of the dynamic present value relation, we have presented evidence that equity mutual fund flows do not directly affect stock market returns in the presence of other market fundamental.Occasionally, the financial press reports that equity mutual fund flows move stock market prices. Some studies report evidence that the equity bull market of the 1990s is attributable to the huge flow of funds into equity mutual funds and that equity mutual fund flows and stock market prices tend to move together over time [e.g., Goetzmann and Massa (2003)].

To gain more insight into the relationship between equity mutual fund flows and stock market returns reported in the popular financial press, we employ various tests and further look at the relationship.A more important test of the relation between return and flow (or volume) takes into account whether there is a relation between the lagged values of the two series. Formally, if the prediction of y using past x is more accurate than without using past x in the mean square error sense [i.e., if $\sigma^2(y_t|I_t) < \sigma^2(y_t|I_t - x_t)$, where I_t is the information set], we say that x Granger causes y, denoted by $x \xrightarrow{G.C} y$.Causality tests can provide useful information on whether knowledge of past securities price movements improves forecasts of future movements in flows, and vice versa. The causal relations are based on a bivariate causality test between market returns and flows. Therefore, to determine whether flows Granger-cause stock returns, or vice versa, the following system of equations is estimated.

$$Kospiret_t = a_0 + \sum_{i=1}^{m} \alpha_i Kospiret_{t-i} + \sum_{i=1}^{m} \beta_i Flow_{t-i} + \varepsilon_{1t} \quad (8)$$

$$Flow_t = b_0 + \sum_{i=1}^{m} \delta_i Kospiret_{t-i} + \sum_{i=1}^{m} \phi_i Flow_{t-i} + \varepsilon_{2t} \qquad (9)$$

Where Kospiret denotes the log difference of KOSPI index, and Flow denotes the log difference of mutual fund flows into the stock market. Both series are stationary variables, and the two disturbance terms, ε_{1t} and ε_{2t},
In equations (8) and (9) are assumed to have zero means, constant variances, and be individually serially uncorrelated.[7] The null hypotheses are that flow does not Granger-cause market performance if $\beta_i = 0$ for all*i*in (8), and that market return does not Granger-cause flow if $\delta_i = 0$ for all *i*in (9).
To test whether volume leads return or return leads volume, the following Granger causality regressions are estimated.

$$Kospiret_t = a_0 + \sum_{i=1}^{m} \alpha_i Kospiret_{t-i} + \sum_{i=1}^{m} \beta_i Vol_{t-i} + \varepsilon_{1t} \qquad (10)$$

$$Vol_t = b_0 + \sum_{i=1}^{m} \delta_i Kospiret_{t-i} + \sum_{i=1}^{m} \phi_i Vol_{t-i} + \varepsilon_{2t} \qquad (11)$$

Where Vol is the log difference of trading volume, Kospiret is the log difference of the KOSPI index. The null hypothesis that volume does not Granger-cause stock market returns is tested by H_0: $\beta_i = 0$, for all *i* in (10). Similarly, the null hypothesis that stock market returns do not Granger-cause volume is tested by H_0: $\delta_i = 0$, for all *i* in (11).Bivariate causality tests between volume and flows are estimated as follows:

$$Vol_t = a_0 + \sum_{i=1}^{m} \alpha_i Vol_{t-i} + \sum_{i=1}^{m} \beta_i Flow_{t-i} + \varepsilon_{1t} \qquad (12)$$

$$Flow_t = b_0 + \sum_{i=1}^{m} \delta_i Vol_{t-i} + \sum_{i=1}^{m} \phi_i Flow_{t-i} + \varepsilon_{2t} \qquad (13)$$

Where Vol is the log difference of trading volume, and Flow denotes the log difference of mutual fund flows into the stock market. Both series are stationary variables. The null hypotheses are that flow does not Granger-cause volume if $\beta_i = 0$ for all*i*in (12), and that volume does not Granger-cause flow if $\delta_i = 0$ for all *i*in (13).

Table 3. Causal Relationship of Korean Stock Market Returns, Equity Mutual Fund Flows, and Volume
Panel A. Bivariate Causality Test

$$y_t = a_0 + \sum_{i=1}^{m} \alpha_i y_{t-i} + \sum_{i=1}^{m} \beta_i x_{t-i} + \varepsilon_t$$

H_0 :$\beta_i = 0$, for $\forall$i (x does not Granger-cause y.)

Causing Variable (x)	Caused Variable (y)	Lags	*F*-statistic	*p*-value	$x \xrightarrow{G.C.} y$
Korean stock market returns and flows					
Kospiret	Flow	1	40.92*	0.00	Yes
		2	25.79*	0.00	Yes
		4	14.28*	0.00	Yes
Flow	Kospiret	1	0.02	0.89	No
		2	1.36	0.24	No

[7] In general, VAR analyses and causality tests assume that the variables in the system are stationary. As such, as a preliminary step, we test for a unit root in variables. To test for a unit root (or the difference stationary process), we employ both the augmented Dickey-Fuller (D-F) test (1979) and the Phillips-Perron (P-P) test (1988) based on the following regressions:

(a) Augmented Dickey Fuller regression :$\Delta x_t = \alpha_0 + \rho x_{t-1} + \sum_{i=1}^{m} \beta_i \Delta x_{t-i} + \eta_t$,

(b) Phillips Perronregression :$x_t = \mu + \alpha x_{t-1} + \varepsilon_t$
The results of unit root tests for Kospiret, Flow, and Vol weanalyze are stationary.

		4	1.54	0.12	No
Korean stock market returns and trading volume growth					
Kospiret	Vol	1	51.53*	0.00	Yes
		2	26.28*	0.00	Yes
		4	15.02*	0.00	Yes
Vol	Kospiret	1	0.08	0.78	No
		2	2.52*	0.03	Yes
		4	2.00*	0.03	Yes
Korean stock market flows and trading volume growth					
Vol	Flow	1	0.05	0.82	No
		2	6.65*	0.00	Yes
		4	7.58*	0.00	Yes
Flow	Vol	1	3.29*	0.07	Yes
		2	13.27*	0.00	Yes
		4	4.26*	0.00	Yes

- "Yes (No)" indicates presence (absence) of causality with a p-value of equal or less than 0.10.
- * Significant at the 10% level.
- Kospiret : The log difference of the Korea Composite Stock Price Index (KOSPI)
- Flow : The log difference of monthlyequity mutual fund flows to the Korean stock market
- Vol : The log difference of monthly trading volume of the Korea Exchange
- The sample period of Kospiret, Flow, and Vol is 1/1/1995-12/30/2016.

Panel B. Three variables (x_t = [Kospiret,Flow,Vol]')

Causing Variables	Caused Variables		
	Kospiret	Flow	Vol
Kospiret	32.01* (0.00)	41.73* (0.00)	49.55* (0.00)
Flow	0.01 (0.91)	32.69* (0.00)	0.04 (0.85)
Vol	0.04 (0.85)	0.87 (0.35)	208.39* (0.00)

Test statistics are derived from a 3-equation VAR with a 1-month lag structure.

- The numbers in each cell are F-statistics for the null hypothesis that the causal variable(s) in each row do not Granger-cause the "caused" variables in each column. A high F-statistic leads to rejection of that hypothesis in favor of the alternative hypothesis, that there is a causal effect.
- The numbers in parentheses are significance levels for the F-statistic; a level less than 0.10 indicates statistical significance. * denotes statistical significance at the 10 percent level.

The results of the Granger causality tests are presented in Table 3. We use both Akaike (1974) and Schwarz (1978) information criteria in conjunction with analyzing the model's residuals to select the appropriate lag structure. Based on these criteria,we select one, two and four lags. Panel A of Table 3 reports the bivariate test of Eq. (8) to (13). Contrary to the popular view of flows leading returns, Korean stock market returns are Granger-causally prior to flows into the market, but whereas equity mutual fund flows do not help predict future KOSPI returns, which is consistent with the results in Section 3.2. in the presence of market fundamentals [see Table 1]. Overall, the findings indicate that the bivariate causal relation is from market returns to equity mutual fund flows. This relation holds either in the presence of fundamentals or not. There is a two-way causation between returns and volume, although causation from returns to volume is much stronger. The evidence for the bi-directional causation is found between flows and volume. The previous causal relations based on a bivariate causal test may not be robust when other relevant variables are introduced into the vector autoregressive (VAR) system. That is, it may be more informative and revealing to discuss a causal relation in the context of informative (or predictive) content and of dynamic interactions. In order to investigate the extent to which a variable helps explain other variables and how a variable responds to shocks in other variables in the system, and to examine the causal relations and dynamic interactions, we estimate multivariate vector auto regression (VAR) models with relevant variables: KOSPI returns, equity mutual fund flows, and trading volume. The results of the trivariate causality test in Panel B are in accordance with those of the bivariate tests.

The analyzed return-flow relationships mirror equity fund flows in the U.S. market.[8] Compared to one-way causation from return to volume (and from flow to volume) observed in the U.S. market results,[9] the bi-directional causation between returns and volume (and between flow and volume) suggests that the Korean stock market volume plays a significant role in forecasting returns and flows. Information flow, however, revealed by volume seems to extend gradually up to several months. This causal relationship conformswith the sequential information arrival model (SEQ).[10]

4. Conclusions

Analysis of the monthly Korean equity mutual fund flows reveals that Korean stock market returns are Granger-causally prior to the fund flows into the market, but not vice versa. We do not find evidence for the price-pressure effect that equity mutual fund flows directly affect stock market prices in the presence of market fundamentals. Instead, we find that equity mutual fund flows seem to be influenced by the performance of the stock market and that investors try to forecast fundamentals of firms and change their demand for stocks accordingly. Our findings imply that at the macro level, there is evidence that investors react stock performances and move their money to yield higher returns. The most important element explaining equity mutual fund flows seems to be stock performance in the Korean stock market.We find that the Korean stock market volume plays a key role in forecasting not only returns but alsomutual fund flows. Information flow, as conveyed by volume,appears to spread gradually up to a period of several months. This causal relationship is consistent with the sequential information arrival model (SEQ).

References

Akaike, H.(1974). A New look at the statistical identification model.IEEE Transactions on Automatic Control, 19, 716-723.

Boyer, B., &Zheng, L.(2004)Who moves the market? A study of stock prices and sector cash flows, Working paper.

Campbell, J. Y. (1991). A variance decomposition for stock returns.Economic Journal, 101,157-179.

Campbell, J. Y., &Shiller.R. J. (1989). The dividend-price ratio and expectations of future dividends and discount factors.Review of Financial Studies, 1, 195-228.

Copeland, T. E., (1976).A model of asset trading under the assumption of sequential information arrival.Journal of Finance, 31, 1149-1167.

Dickey, D., &Fuller, W. (1979).Distribution of the estimators for autoregressive time series with a unit root.Journal of the American Statistical Association, 74, 427-431.

Edelen, R.,& Warner, J. (2001).Aggregate price effects of institutional trading: a study of mutual fund flow and market returns, Journal of Financial Economics, 59, 195-220.

Edwards, F. R.,& Zhang, X. (1998). Mutual funds and stock and bond market stability.Journal of Financial Services Research, 13, 257-282.

Fama, E. F. (1990). Stock returns, expected returns, and real activity. Journal of Finance, 45, 1089-1109.

Fama, E., &French, K. (1989). Business conditions and expected returns on stocks and bonds.Journal of Financial Economics, 25, 23-49.

Fortune, P.(1998). Mutual funds, part II: Fund flows and security returns, New England Economic Review, January/February, 3-22.

Frazzini, A., &Lamont, O.(2005). Dumb money: Mutual fund flows and the cross-section of stock returns, NBER Working Paper 11526.

Goetzmann, W., &Jorion, P. (1993).Testing the predictive power of dividend yields.Journal of Finance, 47, 663-679.

Goetzmann, W, N.,&Massa, M.(2003). Index funds and stock market growth.Journal of Business,76, 1-28.

Harris, L., &Gurel, E. (1986). Price and volume effects associated with changes in the S&P 500 List: New evidence for the existence of price pressure. Journal of Finance, 41, 815-829.

[8] Using bivariate Granger causality tests, Edwards and Zhang (1998) report evidence that fund flows into stock funds have not affected stock returns, which is consistent with our results.

[9] SeeKarpoff (1987) and Saatcioglu and Starks (1998) for a review of the literature on the stock price-volume relation.

[10] see Copeland (1976) for the sequential information arrival model.

Hodrick, R. J. (1992). Dividend yields and expected stock returns: Alternative procedures for inference and measurement.Review of Financial Studies, 5, 357-386.

Karpoff, J.M.(1987). The relation between price changes and trading volume: a survey.Journal of Financial and Quantitative Analysis, 22(1), 109-126.

Keim, D., &Stambaugh, R. (1986). Predicting returns in the stock and bond markets. Journal of Financial Economics, 17, 357-390.

Potter, M., & Schneeweis, T. (1998).The relationship between aggregate mutual fund flows and security returns. Working paper, Babson College.

Remolona, E., Kleiman, P., Gruenstein, D.(1997). Market returns and mutual fund flows.FRBNY Economic Policy Review, July, 33-52.

Saatcioglu. K.,&Starks, L. (1998). The stock price-volume relationship in emerging stock markets: The case of Latin America.International Journal of Forecasting, 14, 215-225.

Schwarz, G.(1978).Estimating the dimension of a model.Annals of Statistics, 6, 461-464.

Schwert, G. W. (1990). Stock returns and real activity: A century of evidence.Journal of Finance, 45, 1237-1257.

Stambaugh, R. F. (1986). Bias in regression with lagged stochastic regressors.CRSP Working Paper No. 156, Univ. of Chicago.

Warther, V. A.(1995). Aggregate mutual fund flows and security returns, Journal of Financial Economics,39, 209-235.

(1998). Has the rise of mutual funds increased market instability? In R. Litan, & A. Santomero(Eds), Brookings-Wharton Papers on Financial Services (pp. 239-280). Washington, D.C.: Brookings Institution.

Frazzini, A., & Lamont, O. (2005). Dumb money: Mutual fund flows and the cross-section of stock returns, NBER Working Paper 11526.